Wildland Biomass to Energy

Renewable Energy Workshop for the
Integrated Energy Policy Report
June 24, 2003

Prepared by
Allen Robertson & Doug Wickizer
California Department of Forestry & Fire Protection

Need for Fuels Reduction

California Fire Plan

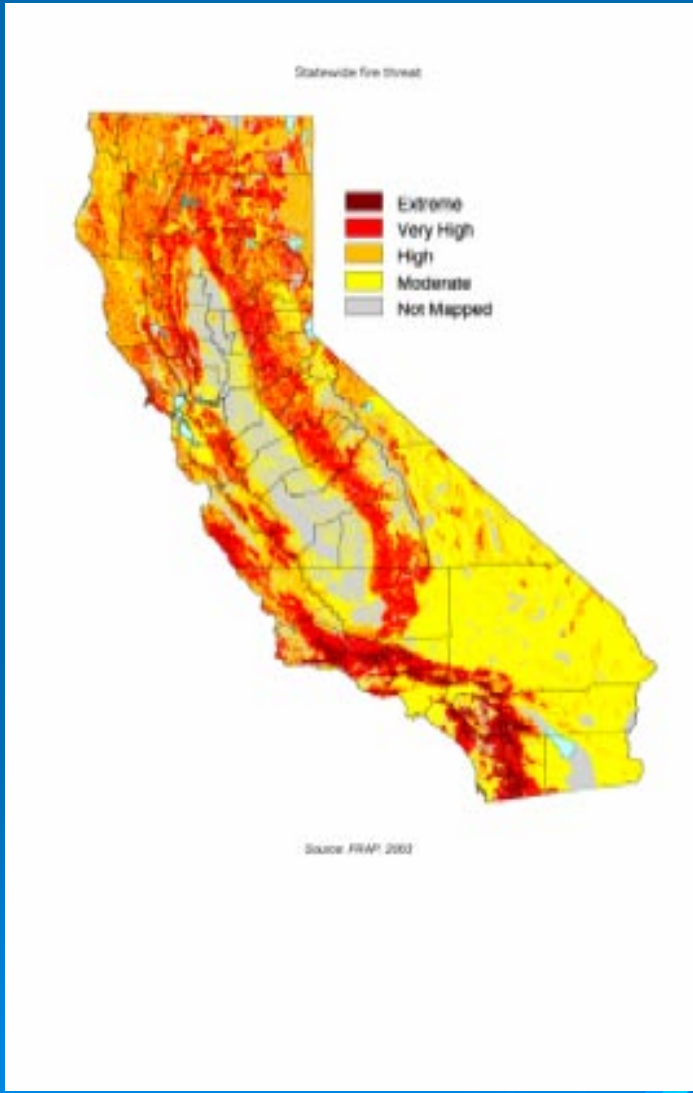
National Fire Plan

- reduce fuels near homes and communities,
- establish fuel breaks,
- modify forest fuels to lessen fire spread.

Need for Disposal and Treatment Methods

- Burning (broadcast, piles)
- Landfill disposal
- Composting
- Energy production (ETOH, electric generation)

Fire Risk



Wildland Fire Threat

Fire threat is an index of both the expected frequency of fire occurring and the fire's physical ability to cause impacts.

Significant fire threat is widespread, with approximately 48 percent of California's forests and rangelands having High, Very High, or Extreme fire threat .

Roughly one–third of California presents a moderate fire threat; there may still be significant impacts from wildfires should they burn under extreme fire weather conditions.

The map of fire threat suggests that areas of highest threat are scattered statewide, with large contiguous zones in southern California, the Central Coast, lower elevations of the Sierra Nevada, and much of the interior of northern California. Fire threat is both widespread and adjacent to many areas of dense population.

Fire-Related Ecosystem Health Risk

Condition class definitions used in risks to ecosystem health assessment

Class	Departure from natural regimes	Vegetation composition, structure, fuels	Fire behavior, severity, pattern	Disturbance agents, native species, hydrologic functions	Increased smoke production
LOW Condition Class 1	None, minimal	Similar	Similar	Within natural range of variation	Low
MODERATE Condition Class 2	Moderate	Moderately altered	Uncharacteristic	Outside historical range of variation	Moderate
HIGH Condition Class 3	High	Significantly different	Highly uncharacteristic	Substantially outside historical range of variation	High

Source: FRAP, 2003

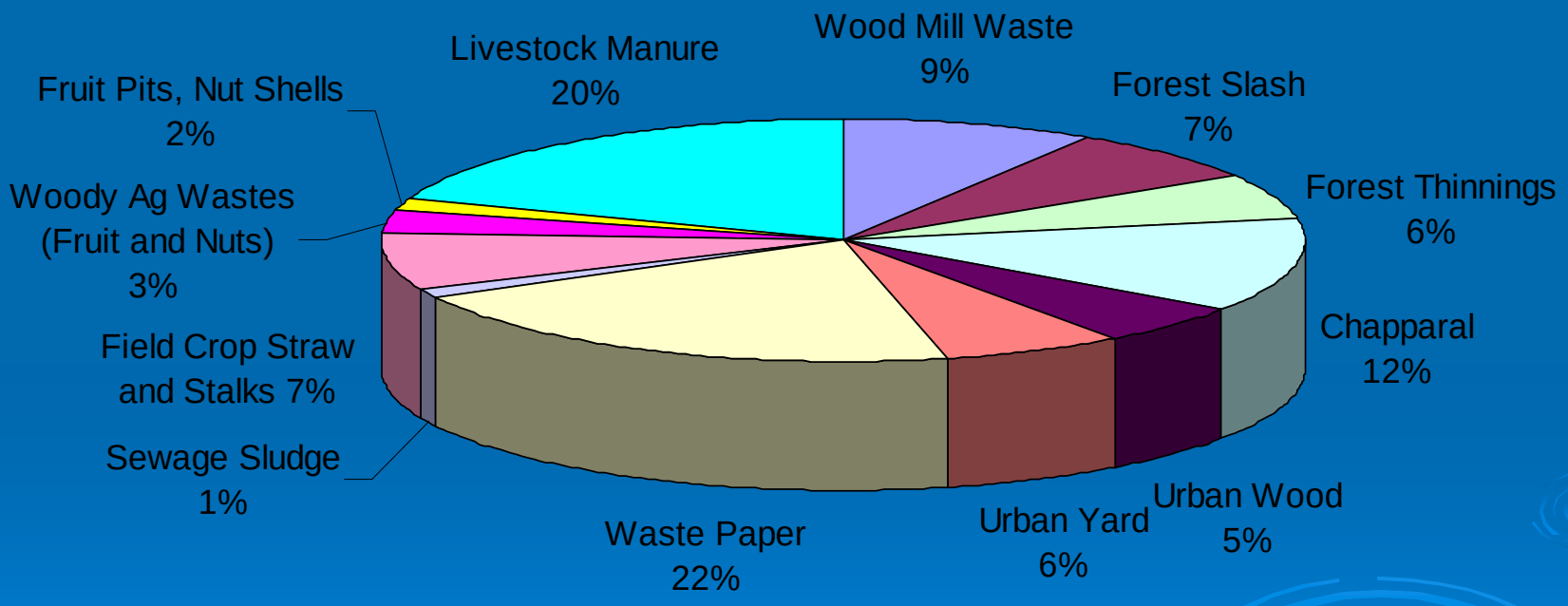
Condition class is a good measure of the expected response of ecosystems to fire given current vegetation type and structure that often is far different from historical fire. Today's wildfire impact to ecosystems results from major disruption of the historical fire regime, increasing fuel accumulation, and the reduction of expected fire frequency.

To evaluate the risks to ecosystem health from wildfire, the moderate and high condition classes are compared to the total forest and rangeland area. Several bioregions have over 60 percent of their forests and rangelands in moderate and high condition classes. These areas have vegetation structures and fire histories that have deviated from historical levels and pose high or moderate risk to ecosystem health. Each bioregion has unique habitats with substantial risk to ecosystem health disturbance. The Modoc region, dominated by sagebrush steppe and the pervasive influence of exotic grasses, has largely lost its basic ecological integrity, and future fires only exacerbates the problem. Similarly, the forested areas of the Klamath/North Coast and Sierra bioregions are at risk due to unnaturally severe fires, where without active restoration efforts post–fire succession may result in loss of forested cover for decades.

Difficulties Implementing Fuels Reduction

- Risk of burning in the interface
- Air pollution from open burning
- CO^2 Reductions
- Landfill Diversions

Opportunities for Biomass Utilization

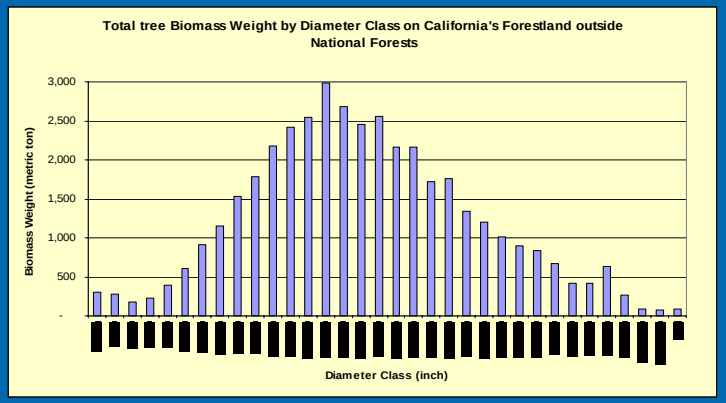


Over 60 million bone dry tons of biomass are generated each year in California

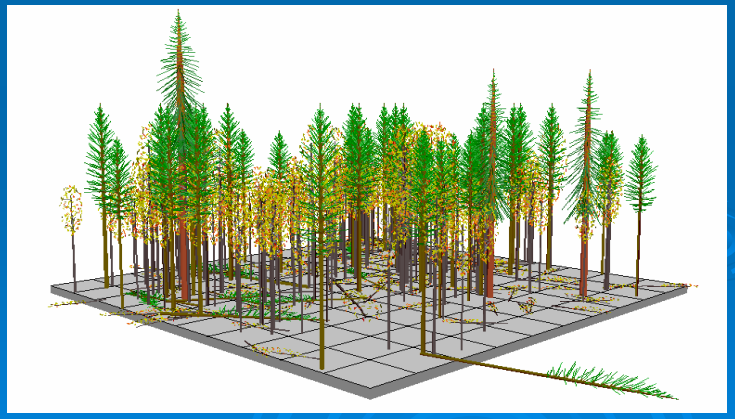
Source: Overview of the Biomass Energy Industry in California. Tiangco, Valentino Ph.D, California Energy Commission, February 19, 2002

Current Forest Biomass Sources

- Chaparral covered lands
  - 9-20 million acres
  - 56-459 million tons of biomass
  - 2 million tons burned annually



- Forest Lands
  - Sawmill residue, logging slash, forest thinning, fuel hazard reduction
  - 13.8 – 18 million tons
  - Most left on site



Sources: Shih, Tian-Ting, Ph.D. 2002. TREE BIOMASS ESTIMATES ON CALIFORNIA'S FORESTLAND, CDF/FRAP

CEC, *Evaluation of Biomass-to-Ethanol Potential in California,* Report to the Governor and the Agency Secretary, Cal EPA, December, 1999, Sacramento

Opportunities for Fuels Reduction

- Timber Harvest Residues
  - From timber harvesting
  - Low potential for burning due to current high level of utilization

- In-forest Residues
  - From fuels reduction
  - High potential for increased usage as biomass

Current CA Woody Biomass Supply and Use

Waste Source	Gross Production (MM BDT/yr)	Current Use (MM BDT/yr)		Est. Available (MM BDT/yr)
		Fuel	Other	
Lumber Mill	5.5	1.75	3.25	0
Forest Slash	4.5	0.25		2.5
Forest Thin.	3.8	0.25		1.4
Urban Wood	3.2	1.0	0.5	0.7
Urban Yard	3.9	0.2	0.5	1.2

Source: Bruce Springsteen, Assessment of California Waste Resources for Gasification, paper prepared for California Energy Commission, May 2002. (rows do not add)

Tree Biomass on CA Forestland

Note: Draft representation of methodology, not currently statistically accurate

Barriers to Fuels Reduction

Technological Barriers:

- Cost to chip, deliver, store, and handle woody biomass
- Efficiencies of DE equipment

Institutional Barriers:

- Non-standardized grid access
- Monopoly practices by utilities
- Emissions standards

State Renewable Energy Legislation

- SB 1078 Renewable Energy Portfolio Standard
  - Mandates 20% renewables by 2017
- SB 1038 – Funding of Renewable Portfolio Standard and Public Interest Energy Research
  - Funding existing and emerging renewable resource technologies
- AB 58 – Net metering interconnection deadlines
  - Extend net metering terms to installations completed by 9/30/2003

State Renewable Energy Goals

- Governor challenged the state's higher education institutions to make their buildings energy self-sufficient through distributed generation.

- Governor's *Commission on Building for the 21st Century* recommended that the State achieve a 25% renewable portfolio by the year 2020.

Biomass Energy Capacity

- Large Scale Generators
  - 35 plants – 685 MW generating capacity
  - Many under short-term contracts, thru 2002
  - No long-term security
- Small Scale Generators
  - Distributed Generation
  - Typically 5KW – 5 MW

Ethanol as an Gasoline Oxygenate

- MTBE to be phased out as an oxygenate in 2003.
- December 31, 2003 - ethanol will be only approved oxygenate per ARB

Washington Ridge Bio-Energy Project

…will construct, install, operate and maintain innovative biomass/energy conversion equipment so as to economically and environmentally demonstrate that the utilization of forest fuels can provide employment and business opportunities through the appropriately scaled production of energy.

Public Cooperators

- Sierra Economic Development District
- CA Department of Forestry & Protection
- California Youth Authority
- USDA Forest Service
- N. Sierra Air Quality Management District
- County of Nevada
- Fire Safe Council of Nevada County

Private Cooperators

- Chiptec Wood Energy Systems
- Capstone Turbine Corporation
- Foresters Co-op

Washington Ridge Bio-Energy Project

Location: Washington Ridge Conservation Camp,
Nevada County, California

Specs: 5MM-BTU/Hr Chiptec Gassifier

Three 30 kW Capstone Turbines

Fuel: 3000 BDTs Biomass

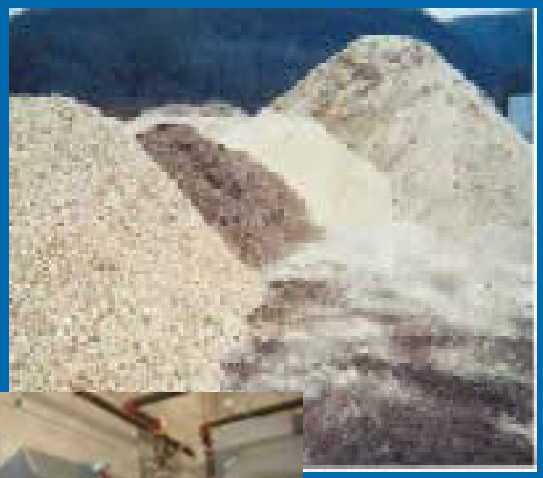
Goal: For the Camp to operate

independent of the grid

Offset: $50,000 Electricity (annually)

$17,000 Propane

Projected Cost per Kwh - $.10 to $.11



Washington Ridge Bio-Energy Project

Future opportunities

- Over forty conservation camps in California
- Typically in rural setting near biomass supply
- Generally reliant on a costly and oftentimes unreliable energy supply
- Workforce available on site
- Fleet of 229 Engines, and an equal amount of administrative vehicles.

Average Cost of Biomass Fuel Production in California ($/bdt)

	Wood Processing Residues	In-Forest Residues	Agricultural Residues	Urban Wood Wastes
Commodity Cost				
Harvesting and Collection	1.00	19.00	10.00	5.00
Processing	5.00	7.50	6.50	6.00
Transportation	6.00	9.50	7.25	9.75
Total	12.00	36.00	23.75	20.75
Range	7.18	25 – 45	18 – 38	13 - 28
Market Price (1999)	22.66	32.27	22.46	20.18

Source: Gregory Morris, Biomass Energy Production in California: The Case for a Policy Initiative, Final Report, NREL/SR-570-28805, November 2000, p.62.

Air Emission

Greenhouse Gas Emission Factors (tons CO2 equivalents/ bdt of biomass)

	Ton/bdt
Biomass Energy	1.76
Open Burning	2.06
Forest Accumulation	3.35
Landfills Uncontrolled	4.24
Gas Collection w/Flare	2.37
Gas Collection w/Engine	2.18
Spreading	2.27
Composting	2.61
Avoided Fossil Fuel	0.52

Note: Factors calculated on a 50-year time horizon comparing greenhouse gas profiles for each of the disposal activities listed calculated as the average atmospheric burden over the period.
Source: Gregory Morris, Biomass Energy Production in California: The Case for a Policy Initiative, Final Report, NREL/SR-570-28805, November 2000., p.47.

Bio-Energy or Ashes

Whether Ethanol, Biodiesel, Minor Products, or Biomass to Electricity –

- Forest biomass must be managed to maintain Forest Health and reduce Fire Hazard.
- Utilization of forest wood waste adds to the local economy (jobs – product)
- Co-benefits such as water quality, wildlife habitat, biodiversity, and recreational opportunities depend on maintaining good forest health.